

## ORTHOPAEDICS INSTRUMENTS

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**Instrument 1****Plaster of paris bandage**

Description:

Plaster of paris impregnated bandage: machine made, commercially available of size (8cm × 10cm).

[Read as written over the pack].

What is the chemical formula of plaster of paris?

$\text{CaSO}_4, \frac{1}{2} \text{H}_2\text{O}$

What is the mechanism of action of plaster of paris?

It is an exothermic reaction, where plaster of paris comes in contact with water and becomes mouldable and then hard.

$\text{CaSO}_4, \frac{1}{2} \text{H}_2\text{O}$  (Soft) +  $\frac{1}{2} \text{H}_2\text{O}$  -----→  $\text{CaSO}_4$  (Hard) +  $\text{H}_2\text{O}$

Name some common uses of plaster of paris.

1. Non-orthopedic uses:
  - ✓ Immobilization after skin grafting
  - ✓ Immobilization after repair of vessel/ nerve injury.
2. Orthopedic uses:
  - ✓ As first aid: Temporary immobilization after any trauma
  - ✓ Definitive management of fractures:
    1. Colles fracture
    2. Supracondylar fracture humerus
    3. Greenstick fracture in children
    4. Fracture of shaft of humerus.
  - ✓ After most orthopedic operations as a slab
  - ✓ Functional cast bracing: Patellar tendon bearing (PTB) plaster for fracture of both bone legs



- ✓ Deformity correction: Serial plaster casting as in CTEV.

Do you know any complication after applying plaster?

- Distal neurovascular deficit due to tight plastering (which may lead to compartment syndrome and VIC)
- Pressure sores on skin.

What advices will you give to the patient after any plaster?

1. Keep the plaster dry, do not bring the plaster in contact with water
2. Encourage continuous movement of free body parts (fingers, toes etc.)
3. Report immediately if:
  - ✓ Fingers/ toes are swollen/ bluish-black
  - ✓ Numbness
  - ✓ Extreme pain not relieved by ordinary doses of analgesics.

How a plaster is applied as a cast?

- The proposed area is wrapped and padded in cotton
- Plaster of paris bandage is dipped in water and retained till no air bubbles are coming out
- Then it is brought out of water and gently squeezed by holding the ends
- Then it is used quickly before it becomes hard
- It is wrapped concentrically, each successive layer overlapping  $\frac{1}{3}^{\text{rd}}$  to  $\frac{1}{2}$  of the previous layer; starting from one end and going to the other end
- While wrapping in successive layers, the following points should be kept in mind:
  - a. Wrap disregarding the fracture site/ underlying pathology
  - b. Avoid wrinkles and creases
  - c. Without excessive tightening or loosening of the wraps.
- End margins are smoothened and the whole surface is polished.

## ***Instrument 2***

### ***Esmarch bandage***

Description:

This is an Esmarch bandage, rolled up and made up of Indian rubber.

What are the uses?

1. Exsanguination
2. Tourniquet.

What do you mean by exsanguination?

Exsanguination means 'to make a bloodless field' in orthopedic operations (especially on limbs).

What are the methods for expressive exsanguination?

- Elevation of the lower limb at  $60^\circ$  for 30 seconds:  
Reduction in blood volume by 45%
- Pressure using an Esmarch or gauze bandage wrapped from distal to proximal:  
Reduction in blood volume by 20%.



Do you know some conditions where exsanguination is contraindicated?

1. Infection (ex: chronic osteomyelitis)
2. Suspicion of malignancy
3. Deep vein thrombosis: May lead to pulmonary embolism.

May lead to spread to infection/ malignant cells

Can Esmarch bandage be a perfect tourniquet?

No, because the pressure exerted cannot be measured/ controlled.

Ideally, pneumatic tourniquet should be always used.

What is the ideal site for applying a tourniquet?

Most proximal part of limb (where there is single bone and adequate muscle bulk).

Do you know some conditions where tourniquet cannot be used?

Tourniquets cannot be used in conditions/ diseases where there is already a state of compromised vascularity:

1. Burger's disease
2. Sickle cell anemia
3. Crush injuries.

Do you know any complication of using tourniquet?

1. Compartment syndrome
2. Pulmonary embolism.

### **Instrument 3**

#### ***Faraboeuf's periosteum elevator***

Description:

1. Handle: For gripping.
2. Thumb rest: For better gripping and preventing slipping.
3. Sharp, beveled and curved tip: applied to the bone, to strip off the periosteum.



Which instrument is required before applying this instrument?

Scalpel, to cut the periosteum.

Which instrument is required after applying this instrument?

Bone levers, to hold the periosteum and to prevent slipping.

What are the advantages of using bone levers?

1. To prevent slipping of the periosteum
2. To put the vessels and nerves retracted away from the operative zone.

This instrument is used in almost all orthopedic operations. Do you know any operation where Faraboeuf's periosteal elevator is **not** used?

1. Operations on patella
2. Removal of exostosis.

Why Faraboeuf's periosteal elevator is **not** used in removal of exostosis?

Because while removing exostosis, one has to remove both bone and periosteum to prevent recurrence. So, periosteal elevator is not required.

#### **Instrument 4**

##### **Osteotome**

Description:

1. Blunt, flat end: For the mallet [hammer] to strike
2. Handle: To hold with the non-dominant hand
3. Quadrangular flattened shaft: To cut bone
4. Tip: **Two side beveled tip.**

What is the general purpose of using this instrument?

Osteotomy.

What do you mean by osteotomy?

Osteotomy is surgical sectioning of bone. It is taking out a part/ all of a bone// cutting into/ through a bone.



What are the common uses of this instrument?

1. Osteotomy:
  - ✓ French osteotomy
  - ✓ McMurray's osteotomy.
2. Taking bone graft
3. Removal of exostosis
4. Saucerization.



What is done before using osteotome?

- Drill some holes in the line of proposed osteotomy
- Then osteotome is used to join the drill holes
- The bone is cut.

What is the purpose of doing this before using osteotome?

The **pre-drilling** weakens the cortex, prevents "**chipping-off**" (fragmentation) of bone and irregularity of the osteotomised bone surface; thus ensures a straight, smooth clean-cut bone surface at the desired angle and direction.

**Instrument 5**

**Chisel**

Description:

1. Blunt, flat end: For the mallet [hammer] to strike
2. Handle: To hold with the non-dominant hand
3. Quadrangular flattened shaft: To cut bone
4. Tip: ***One side beveled tip.***

What is advantage this 'one sided beveled tip'?

If the beveled surface is in bone contact while cutting, a thin slice of bone is removed easily.

Have you seen this instrument in any operation in your college?

No (it is mostly replaced by osteotome).

Name some common uses of this instrument?

1. Bone graft removal
2. Saucerization.

What is the most common site of bone graft removal?

Iliac crest.





***Instrument 6 and 7***

***Steinman pin and Bohler's stirrup***

Description:

Steinman pin:

It has:

- One sharp trocar pointed end
- A rounded smooth shaft
- A blunt end with quadrangular cross section.

Bohler's stirrup:

It has:

- A rounded loop
- 2 limbs
- 2 screw (for securing Steinman pin).



- Bohler's stirrup is attached to Steinman pin which allows the direction of traction to be varied *without turning the pin in the bone*.
- Steinman pin may also be used along with bone drillers.

What is the use of these instruments?

For skeletal traction.

What is the most common site of skeletal traction?

Proximal tibial traction:

- 2 cm posterior and inferior to the tibial tubercle.
- Used for trochanteric, sub-trochanteric and femoral shaft fractures in adults.

What is the direction of introducing Steinman pin while giving proximal tibial traction?  
Why?

Lateral to medial, to prevent damage to common peroneal nerve.

Name some other sites where skeletal traction can be given?

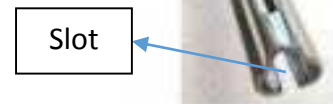
1. Distal tibial traction
2. Distal femoral traction.

### ***Instrument 8***

#### ***K nail***

Name the instrument.

Kuntscher's intramedullary nail.



What are its parts?

1. 2 blunt ends: For easy insertion
2. Cross section: Clover leaf appearance (to prevent internal rotation within the femur)
3. A tube which is hollow and having a slot.

What is the use of this instrument?

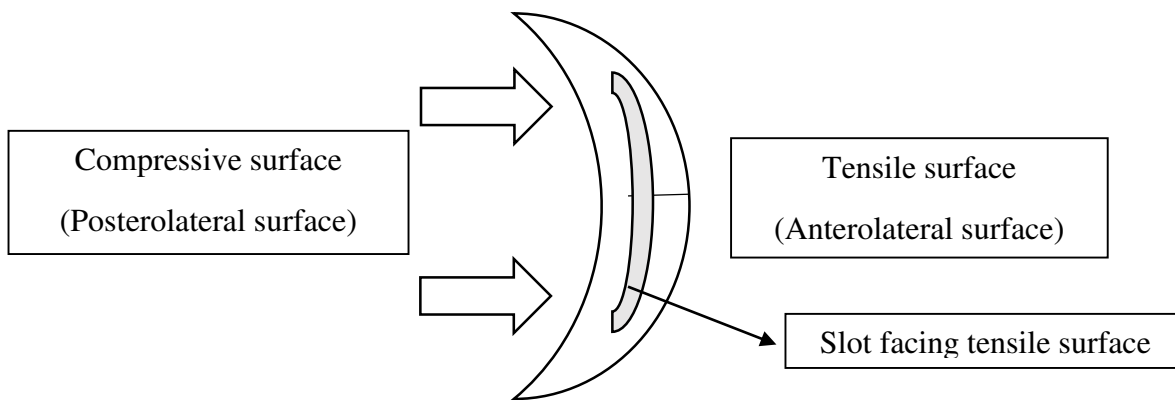
For fixation of diaphyseal fracture of femoral shaft.

What is the purpose of the slot in K-nail?

- Femur is not a straight bone, but it has a natural antero-lateral bowing.
- While inserting a straight bone in a curved canal. The nail has to adjust by bending slightly; otherwise it would fracture the cortex at the bone curve.
- If there was no slot in K-nail, it would be weak at the bend on the tensile surface and might break when body weight is applied.
- So the slot has to be faced anterolaterally (tensile surface).

[See next page]





### **Instrument 9**

#### **Rush nail**

Description:

- One beveled end
- The opposite end is bent like hockey stick
- Cross section: Cylindrical.

What is the advantage of the bent?

- I. Prevent migration of the nail within the bone
- II. Provides good grip for removal.

Name some of the common uses of rush nail?

Diaphyseal fracture of long bone:

- I. Fracture both-bone forearm
- II. Fracture fibula distal 1/3<sup>rd</sup>.

What is the disadvantage of rush nail?

- I. Does not prevent rotational movement at fracture site
- II. There is no locking mechanism (as it is cylindrical in cross section).

